

QUARTERLY PROGRESS REPORT  
CONTRACT NAS 8-1646  
TOPOLOGICAL DYNAMICS

JANUARY - FEBRUARY - MARCH 1956

During the first quarter of 1956 the following research was performed on Contract NAS 8-1646.

A study was made of various topological approaches to dynamic systems in order to determine which methods could yield physically interesting results with a reasonable degree of facility. The study indicated that the representation of fixed-point theorems in physical geometries could provide practical information.

The first problems analyzed were one dimensional dynamic systems with potentials periodic in time. The use of a one dimensional model should not be interpreted as unduly restrictive, since many higher dimensional and, in particular, perturbative problems with dynamic potentials can be reduced to the above one dimensional system. The approach yielded a parallel development of the Floquet analysis of Hill's lunar theory and the general properties of Mathieu functions.

The next problem analyzed was the motion of body about an oblate, Newtonian geoid. The oblateness is described by the second Legendre polynomial,  $P_2(\cos\theta)$ , in accordance with the major perturbation of a close-in earth satellite. Despite the relative complexity of the model, it has many interesting topological properties, e.g. unstable periodic motion which degenerates to almost periodic motion and tends asymptotically to a stable periodic state.

The constant, secular, and periodic perturbations of the two body motion

N66-32139

CR-76564

page-6

Cat 19

Report to Marshall Space Flight Center- Con't.

were analyzed by classical methods so that any topological results could be compared with known behavior. The topological analysis of this model is in progress, and any results will be presented in the next progress report.